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AUTHOR Pace, C. Robert
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ABSTRACT

This paper seeks evidence of a culture gulf, first voiced by C.P. Snow in 1959, between science and humanities as reflected in the understanding which undergraduate science and humanities majors have of the other field. The 1995 study evaluated responses of students at the University of California Los Angeles (UCLA) and California's Humboldt State University (HSU) to the College Student Experiences Questionnaire, which measures both general cognitive outcomes and personal/social outcomes. The study found some differences between science and humanities majors, although not as great as those reflected in Snow's study of eminent physical scientists and literary intellectuals. The study did find that science majors reported greater progress in analytical skills while humanities majors report greater progress in interpersonal skills. These differences were consistently greater at UCLA than at HSU. The data examining these differences, using Holland's (1959) theory of vocational choice, suggest that they may be the result of institutional environment and context. (Contains 8 references.) (CH)

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Contrasts between Science and Humanities Majors in Undergraduate Outcomes and Activities

C. Robert Pace

2750 Hilltop Court

Arcata, CA, 95521

(707) 822-1204

Paper presented at the annual meeting of ASHE

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(409) 845-0393

This paper was presented at the annual meeting of the Association for the Study of Higher Education held in Memphis, Tennessee, October 31 - November 3, 1996. This paper was reviewed by ASHE and was judged to be of high quality and of interest to others concerned with higher education. It has therefore been selected to be included in the ERIC collection of ASHE conference papers.

Contrasts between Science and Humanities Majors in Undergraduate Outcomes and Activities

C. Robert Pace

In what became his very memorable lectures at Cambridge, C.P.Snow (1959) described two cultures. He said, "The intellectual life of the whole of western society is increasingly being split into two polar groups...literary intellectuals at one pole, at the other scientists...Between the two a gulf of mutual incomprehension...lack of understanding." He attributed this condition to the extremely high degree of specialization in British higher education. He also believed that a similar degree of specialization existed in the research universities of the United States.

Today, nearly 40 years later, is there evidence that a gulf between two cultures can be found in undergraduate education in the U.S.? The evidence presented here comes from student responses to the College Student Experiences Questionnaire (CSEQ) at UCLA in 1993 and at Humboldt State University (HSU) in 1995. Unlike C.P.Snow, who contrasted physical scientists and literary intellectuals at the highest levels of distinction, the present study compares undergraduate science majors with undergraduate humanities majors, and defines science majors as physical and biological sciences, and humanities majors as including literature,

history, philosophy, and arts. With these more inclusive definitions the gulf between the two cultures should be narrower. The gulf itself is defined, in the present study, by noting how much progress science majors believe they have made toward humanities outcomes, and how much progress humanities majors believe they have made toward science outcomes.

The present study raises three questions: 1) Are there two cultures today in undergraduate education? 2) Does the major field have an influence on general cognitive and non-cognitive outcomes? And 3) Why is the gulf between the two majors much narrower at HSU than at UCLA?

Are there two cultures? The answer is yes but the differences between them do not conform to the extremist language used by C.P.Snow. At UCLA from a fourth to nearly a half of the science majors believe they have gained substantially in their understanding, acquaintance, and enjoyment of literature and the arts, in their awareness of different philosophies, and in seeing the importance of history. At HSU a little more than one fifth of the humanities majors believe they have made substantial progress in understanding the nature of science and experimentation and new developments in science and technology. At UCLA however, only 7% of the humanities majors indicated substantial progress toward those science outcomes. Table 1.

The second question considers the extent to which each major field influences other aspects of the college

Table 1

TWO CULTURES CONTRASTS

	SCIENCE MAJORS % Substantial gain at UCLA	at HSU
HUMANITIES GAINS		
Literature	30	29
Arts	24	31
Philosophy	49	57
History	34	55
(average)	(34)	(43)

	HUMANITIES MAJORS % Substantial gain at UCLA	at HSU
SCIENCE GAINS		
Science	6	26
Technology	7	17
(average)	(7)	(22)

experience. We know from more than a half century of achievement testing (Pace 1979) that students know more about the subject matter of their major field than about the subject matter of other fields, and that students make their highest scores on tests that are most closely related to their major. In their comprehensive review of research, Pascarella and Terenzini (1991) report that on comparisons between freshmen and seniors the effect size is largest for specific subject matter knowledge. They also note that "students tend to demonstrate their highest levels of learning on subject matter tests most congruent with their academic major" (page 614). They go on to say that the major field may have little impact on more general levels of intellectual or cognitive development and even less on non-cognitive outcomes. So, how influential is the major field in the overall college experience?

In the list of goals or outcomes in the CSEQ three are selected that describe general intellectual skills and two that describe non-cognitive or personal/social development outcomes as follows:

Ability to think analytically and logically

Ability to put ideas together, to see relationships, similarities, and differences between ideas

Ability to learn on your own, pursue ideas, and find information you need

Understanding yourself - your abilities, interests, and personality

Understanding other people and the ability to get along with different kinds of people

At UCLA the academic major has no effect on the general cognitive outcomes of synthesis or inquiry and on the non-cognitive outcome of self-understanding; but significantly more science majors report progress with respect to analytical skills and significantly more humanities majors report progress toward interpersonal skills. At HSU the results are generally similar. Table 2. There is, of course, a selective attraction between students and major fields and the results probably reflect this attraction. A more extensive picture of the major field's influence is seen in a list of the differences of 10 percentage points or more between Sci and Hum majors on all outcomes. Table 3. Clearly the biggest differences are related to science outcomes, and the next biggest differences are related to humanities outcomes. Overall, the influence of the major field is mainly a subject matter influence. With respect to other outcomes, a mixture of intellectual and personality characteristics may be more influential.

Another way to examine the general influence of the major field is to note the level and scope of activities invested in the college experience. The mean scores on each

Table 2

INFLUENCE OF MAJORS ON GENERAL OUTCOMES

	% substantial gain			
	at UCLA		at HSU	
	SCI	HUM	SCI	HUM
Analysis	80	55	85	61
Synthesis	74	73	80	70
Inquiry	75	76	83	85
Understand self	71	76	73	77
Understand others	57	76	67	77

Table 3

Differences between SCI & HUM majors of 10 points or more in outcomes

	UCLA	HSU
Science *	65	64
Technology *	59	63
Consequences S/T	39	40
Quant thinking	56	50
Analysis, logic	25	24
Computers	14	29
Literature *	42	35
Arts *	39	24
History *	28	25
World	18	37
Others	19	10
Specialization	28	10
Philosophy *	17	(7)
Write	23	
Breadth	18	
Values, ethics	17	
Vocational prep		27
Career relevance		17
Synthesis		10
Team		14

of the activity scales in the CSEQ on which the difference between the means of majors was 1.0 or more are listed. Table 4. At UCLA differences of that size occured on 11 of the 13 scales. At HSU differences of that size occured on 6 of the 13 scales. At HSU the level of engagement of science majors and humanities majors are comparable with respect to Course Learning, Conversation Topics, Conversation Information, Student Union, Athletic and Recreation Facilities, Clubs and Organizations, and Personal Experiences. The significant differences in mean scores occured on topics more closely related to the major fields - for example, among humanities majors, Library Experiences, Experience in Writing, Art/Music/Theater, and Student Acquaintances.; and for science majors the Science activity scale.

In all of the comparisons between majors the contrasts are greater at UCLA than at HSU. Put another way, the gulf between sciences and humanities is much narrower at HSU. For example, the average percent of humanities majors who believe they have made substantial progress toward science goals was only 7% at UCLA compared with 22% at HSU; and the percent of science majors reporting substantial progress toward humanities goals was 34% at UCLA compared with 43% at HSU. Are there some plausible explanations for this? Or perhaps one should ask whether there are some plausible speculations.

It is possible, for example, that the disciplines at HSU would be classified somewhat differently from their counterparts at UCLA. Biglan's (1973) classifications as

Table 4

ACTIVITY SCALE MEAN SCORES

	Differences of 1.0 or more between SCI and HUM majors	
	at UCLA	at HSU
Science	10.5	12.5
Art,music,theater	7.7	3.7
Writing	4.2	3.4
Faculty	1.8	1.1
Student acquaint	1.4	2.4
Library	1.1	1.2
Personal exps	3.1	
Conv topics	2.5	
Clubs & orgs	1.8	
Course learning	1.6	
Athletic/recr	1.6	

hard/soft and pure/applied might reveal differences if one examined the course descriptions. Braxton and Hargens(1996) suggest that the level of consensus may be an especially important dimension--consensus regarding theoretical orientations, proper research methods, and the importance of research questions. Physics would be a high consensus field. The humanities would be low consensus fields. A more diagnostic line of speculation draws on Holland's (1959) theory of vocational choice in which occupations are classified along six dimensions: realistic, investigative, artistic, social, enterprising, and conventional. Then, in an article by Astin and Holland (1961) the choice of a major is regarded as similar to the choice of an occupation and majors are then classified by Holland's six dimensions. A more recent and extensive classification of more than 900 majors by Rosen, Holmberg, and Holland (1989) gives a summary code for each major consisting of the three most relevant personality dimensions in Holland's theory. Table 5.

To interpret this information one needs to see the larger institutional environment or context within which the major fields are located. For example, the institutional environment at UCLA emphasizes research and graduate study. At HSU the emphasis is on undergraduate teaching. But even more significant is the object of applications in the sciences and their place in the university organization. Uniquely at HSU all the sciences are located in the College of Natural Resources and Sciences -- a college which includes

Table 5

HOLLAND'S CLASSIFICATION OF VOCATIONS/MAJORS

R = Realistic
I = Investigative
S = Social
C = Conventional
E = Enterprising
A = Artistic

Sciences		Humanities	
Biol	IRE	Arts	ASI
Chem	IRE	Lit	AES
Phys	IRE	Phil	SAI
Math	IRE	Hist	SEI
Geol	IRE		

Other SCI majors at HSU

Wildlife management	SER
Forestry	RIS
Rangeland resource sciences	IRS ?
Natural resources plan	RES ?
Environ resources engr	RES ?
Fisheries	REI/ISR
Oceanography	RIE

along with the usual departments of biology, chemistry, math physics, and geology, the departments of Fisheries, Forestry/Watershed Department, Environmental Resources Engineering, Natural Resources Planning and Interpretation, Oceanography, Rangeland Resource Sciences, and Wildlife Management. It is this larger context of environmental sciences that gives to all the sciences a distinctive importance and influence at the institution. The focus of this larger context is a pervasive concern for the quality of environment we all live in. It is this concern with values that probably narrows the gulf between sciences and humanities at HSU. This overlapping concern with quality and values is also reflected in Holland's theory. In all of the humanities one of the dimensions is Social, and in the related science fields at HSU it is the Social dimension that distinguishes them from traditional science majors. At HSU science connects with humanities by knowledge and action related to the quality of the environment. Perhaps the gulf that often exists between science and humanities could be substantially narrowed elsewhere when students can clearly see the relation between and science and survival. For more insightful research a valid way to locate and measure larger institutional influences on smaller departmental influences would be useful.

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